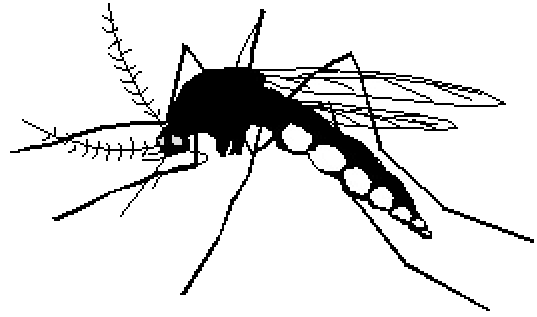


MOSQUITO CONNECTION



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What's Going On at the Tres Rios Demonstration Project?

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Research Project Manager

Tres Rios Demonstration Constructed Wetland Project

The Tres Rios Demonstration Constructed Wetland Project entered its 44th month of operations during Summer 1999. The project currently consists of two demonstration- size wetland sites, the Cobble (4.5 acres) and Hayfield (6 acres) sites and a smaller research cell facility.

The wetlands were originally planted with two primary species of bulrush (*Scirpus validus* and *S. olneyi*). Both species grew robustly for the first three growing

seasons, but large amounts of standing dead and matted vegetation developed thereafter. Although this did not compromise the water quality performance (Tres Rios are polishing wetlands), it did set up conditions favorable for uncontrolled breeding of mosquitoes.

Since the spring of 1996, multiple management tools have been used in an attempt to minimize mosquito production in these systems. Monitoring adult and larval mosquito for species, sex and total numbers have been and continue to be a weekly effort at all wetland basins and surrounding areas. Biological controls, larvicide applications, and adulticiding have been conducted in the past. Biological controls used at Tres Rios include introduction and maintenance of viable populations of the common mosquito fish (*Gambusia sp.*) and the fostering of macroinvertebrate populations through water quality improvements and vegetation diversity.

Larvicides used at Tres Rios have included derivatives of both *Bacillus thuringiensis* (VectoBac) and *B. sphaericus* (VectoLex) in granular formulations. Both agents are specific for mosquito larvae and negative impacts to non-target species such as diving beetles; dragonflies and damselflies have not been observed. Chronic biotoxicity testing has been conducted while these larvicides are in the basins and no observable effects have been noted with respect to the test organism *Ceriodaphnia dubia*. In fact, wetland treated effluent usually produces more young test organisms than the conventionally treated wastewater.

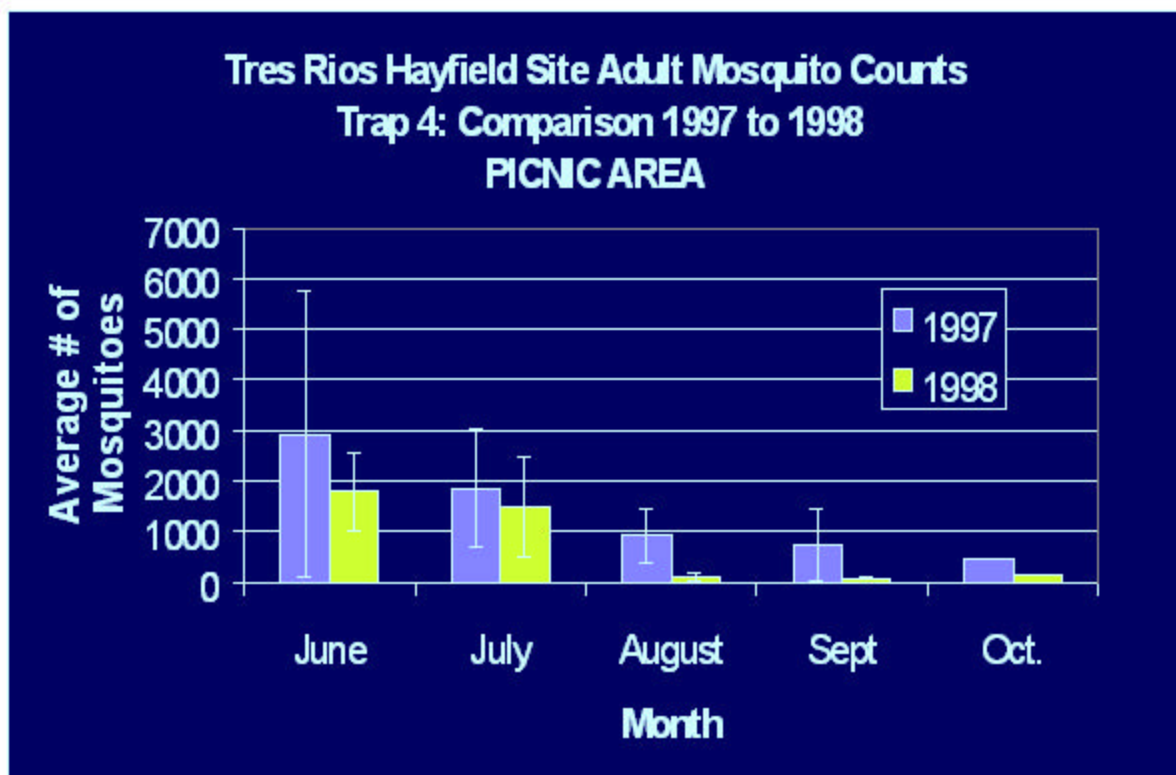


Figure 1 . *Average adult mosquito counts at the Tres Rios Hayfield Site Wetlands in 1997 and 1998. Vegetation thinning and modified larvicide application began July 23, 1998. Error bars represent 1-standard deviation and show the high variability in adult mosquito counts.*

Experience at Tres Rios indicates that both varieties of larvicides are effective, as long as basin coverage and penetration of dense vegetation is achieved. This was indicated in July 1998, when two actions were taken. First, the vegetated areas of the basins were reduced to provide a more complete ecosystem, allow for better fish access, and further to improve the chances of getting the granular larvicides to the water surface where larvae can contact it. Second, the method used to apply the granular larvicides was modified from a dry application to that of a water slurry. This was achieved by means of a commercial hydro-seeder truck. By choosing different nozzles this allows for almost 90% basin coverage (lineal distance approx. 100ft.) and the water carrier "washes" the granular material through dense vegetation. Larvicide treatments were applied at a rate of 20 lbs./acre every 10 days beginning the second week of August 1998 and were discontinued in December 1998. This year, the first complete larvicide application was not conducted until May 7th. The next treatment took place June 14th.

Larval dipping since August 1998 has shown high percentages of 1st instar larvae (>50%) percentages of 4th (<10%). The lack of late instars and pupae may indicate that the larvicide application is effective, or it could be a reflection of the inherent variability of mosquito populations, but it is encouraging nonetheless.

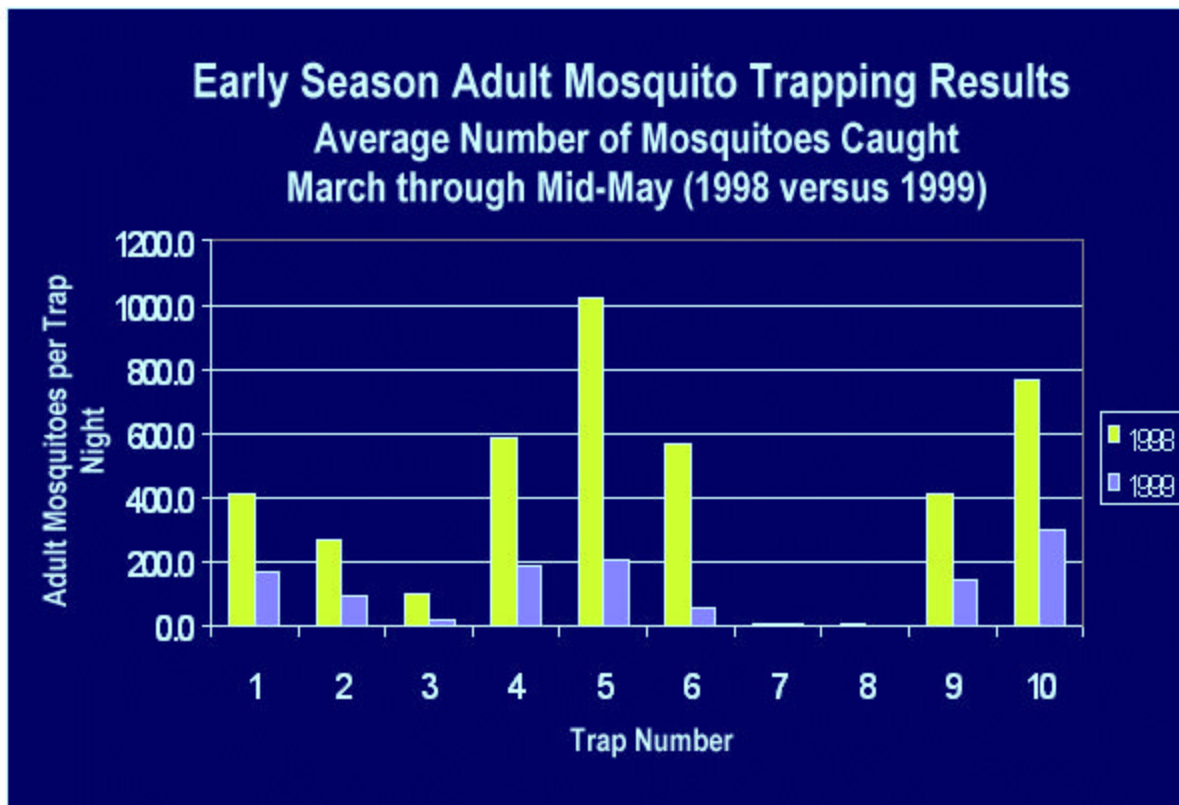


Figure 2. Snapshot of the spring 1998 and 1999 average adult mosquito counts for the 10 Tres Rios sampling sites. All traps show lower counts in 1999 versus 1998 including the Salt River traps 1, 5, 9, and 10. Trap 2 is located between the Cobble basins, while traps 4 and 6 are Hayfield Site wetland locations

Adult mosquito populations trapped at the wetland sites have also been lower after the vegetation and larvicide application modifications took place. Figure 1 provides a summary of average adult mosquito populations in 1997 versus 1998 for the late summer and fall mosquito season. These data suggest a decrease in mosquito population beginning in August 1998 that has continued through the spring of 1999. It should be noted that overall mosquito counts are lower in 1998 than in 1997.

Figure 2 shows a summary of average mosquito trap counts obtained at all 10 of the Tres Rios Weekly Adult Monitoring Trap Sites for the spring mosquito seasons of 1998 and 1999. In this plot, all traps monitoring wetland basins are averaging < 200 mosquitoes per night, which is reduced over that of last year. This plot also indicates that mosquito populations in general are lower this year than in 1998 in both traps associated with wetland and background areas. Trap 2 is reflective of the Cobble Site basins, while traps 4 and 6 represent the Hayfield site. Traps 1, 5, 9, and 10 are located in the Salt River bed are indicative of mosquitoes breeding there. Traps 7 and 8 are located on the north perimeter fence-line of the 91st Ave. WWTP and represent dry agricultural conditions. Trap 3 is located at the research cell facility

that was taken out of service for redesign in February 1999.

The Future?

Although the results of reducing the vegetation density and/or increasing vegetation diversity and better aerial coverage and penetration of larvicides are encouraging, much more time is needed to assess if reductions are a result of management strategy or just the normal fluctuation in mosquito populations. As such, we still have some work to do. The following is list of activities underway:

- Assessing the changes in basin configuration, vegetation, and larvicide application as the wetland systems mature.
- Since more and more evidence suggests that the Tres Rios constructed wetland basins produce mosquitoes in numbers less than or equal to surrounding areas more monitoring sites are being added and capture, mark, and release study is being finalized
- A Pest Abatement District is being formulated to address vector and nuisance conditions in the full-scale project area.
- Draft *Mosquito Control Strategy for Treatment Wetlands* document should be available in November. (*Ed. Note: The number of copies available for distribution may be limited. To find out availability and possibly order, contact Roland at 602-495-7927.*)
- Using the above draft document and a design team made up of vector control, public health, and treatment wetland experts to design a couple of 2-acre wetland basins in the former research cell site. These basins will try different substrates, vegetation planting schemes, and operational variations to attempt to minimize mosquito production while meeting our water quality and habitat objectives. The design has been completed; construction is pending.

In all, mosquitoes are part of most aquatic ecosystems and provide a substantial food base. In treatment wetlands, our goal will be to manage, not eradicate these organisms. We've a long way to go, but we're not tired yet, so stay tuned.



Sweetwater Wetlands Mosquito Control Update

Wet Year Complicates Mosquito Problems Statewide

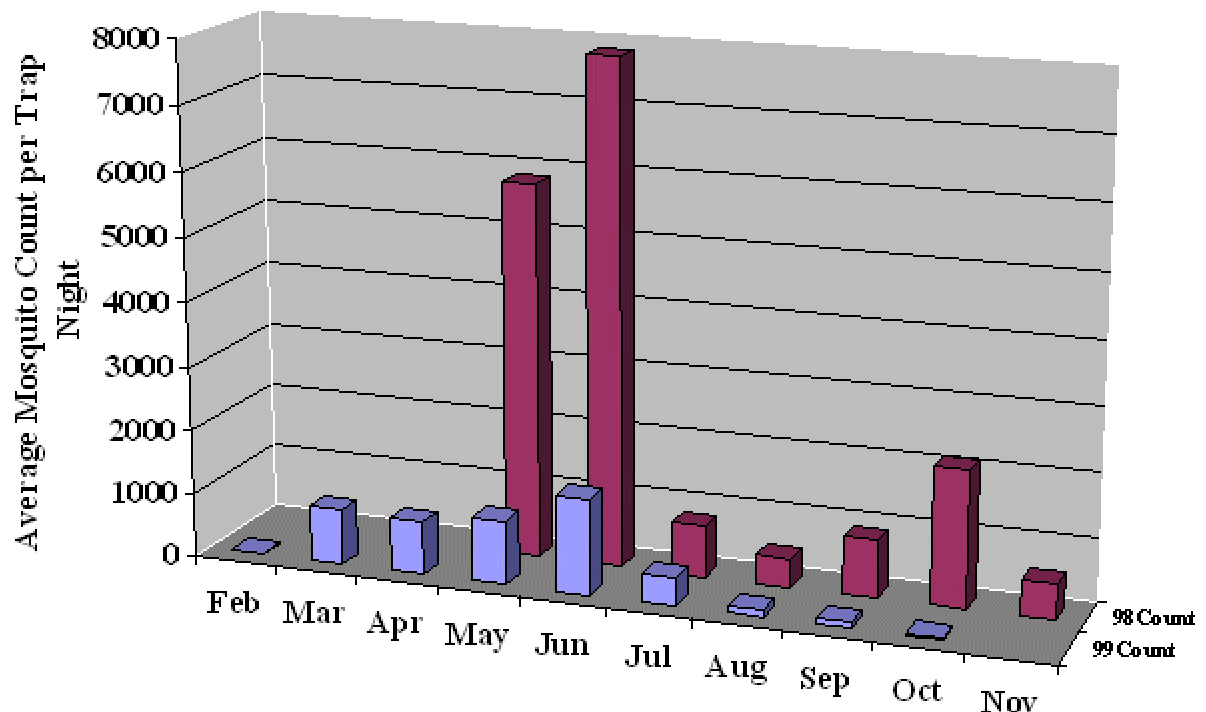
(Editor's note: State Health officials this season have documented increased detection of encephalitis virus-carrying mosquitoes throughout Arizona. Four such samples were documented at Sweetwater Wetlands [Tucson]; 14 other samples were detected at other areas in the State. This article is an update of continuing efforts to reduce mosquito populations at the wetlands. While no control program can eliminate all mosquitoes and all potential risk, Sweetwater's 1999 mosquito control program has reduced mosquito counts.)

*Bruce Prior, Hydrologist
City of Tucson Water Department*

Applications of an insect growth regulator, larvicides and adulticides have significantly reduced Sweetwater Wetlands mosquito populations in 1999. Figure 1 compares mosquito trap counts at the wetlands between 1998 and 1999.

The trap count results, provided by the University of Arizona Entomology Department, demonstrate that the aggressive mosquito control program conducted early this year significantly reduced the mosquito population. During the five-month period from May to September when comparable trap count information was available for 1998 and 1999, the average reduction in mosquitoes in 1999 was 82 percent. The *per-month* reduction in mosquito counts ranged from 66 to 89 percent.

The mosquito population spikes during May and June 1998 occurred before the aerial application of larvicide (aerial application began July 1998 and continued weekly through October 1998, when the program was halted for the winter). Based on the high 1998 mosquito counts, staff recognized the need to begin applying larvicide earlier in the 1999 season.



*Figure 1. 1998-1999 Mosquito Population Comparison
Sweetwater Wetlands*

The 1999 mosquito control program began in mid-April with the application of Methoprene, an insect growth regulator that prevents larval mosquitoes from developing into adults. Also beginning in April, two biological larvicides were applied, alternating each product on a weekly basis. Both the Methoprene and the larvicides are effective for controlling mosquito larvae, but do not harm other aquatic arthropods, birds, or mammals.

To further reduce mosquito counts later in the season, beginning on August 30, staff began a mosquito adulticide program. The adulticide is applied via an Ultra Low Volume (ULV) truck-mounted fogger that distributes the product at approximately one-ounce per acre. The first application used the Malathion compound Fyfanon, which has a noticeable odor. Subsequent applications used an equally effective synthetic pyrethroid, Sumithrin, due to its milder odor.

The frequency of application was increased from bi-weekly in August and September to twice a week in October. Adulticide and larvicide application programs continued through October. Additional treatments beyond October will depend on weather conditions and/or guidance from local or state public health officials. (Since the same larvicides were applied weekly in both 1998 and 1999, the September-October trap count differences between the two years can be attributed to the additional use of adulticide.)

Mosquito Abatement Plan for 2000

The main tools in the abatement program for 2000 will again be the insect growth regulator Methoprene, larvicides, and an adulticide. Based on the increase in mosquitoes seen in March 1999, next year's larvicide program will begin in March, a month earlier than this year. Adulticide will be applied during the two primary Culex Tarsalis breeding periods of early summer and autumn.

Staff also continues to evaluate wetland vegetation species to determine if some changes could make mosquito control more effective (we have contracted with the University of Arizona to assist with this revegetation effort). Dethatching of bulrush began in October 1999, in select locations to maintain the water treatment needs of the facility. Similarly, the use of mosquito larvae-eating fish has been considered before, and will continue to be evaluated.

Tucson Water continues to cooperate with the Pima County Health Department, the Arizona Department of Health Services, and the University of Arizona regarding mosquito control at the Sweetwater Wetlands and other water projects. While the significant reduction in mosquito counts demonstrates that our control program is effective, we will continue to investigate how to further reduce the mosquito population at this and other planned projects.

Finally, it has been gratifying to observe a profusion of Western Pygmy Blue butterflies, the smallest in North America, at Sweetwater during October 1999. For these fingernail-size insects to thrive during mosquito adulticiding operations suggests that the ULV application is, as advertised, more of a "mosquitocide" than an "insecticide."



Organization Provides Mosquito Information Resource

Most professionals recognize the value of seeking and sharing information with peers, particularly on complex topics. Did you know there is a professional organization, which has been dedicated to mosquito control issues for more than 60 years?

The American Mosquito Control Association (AMCA) was founded in 1935. Headquartered in Lake Charles, Louisiana, its membership spans the nation. The organization hosts an annual meeting, makes available to members a quarterly technical journal and newsletters, and has an in-house reader service which sells bulletins, slides, and videos.

The AMCA web site (<http://www.mosquito.org/>) updated frequently, lists

upcoming events, locations of mosquito abate districts throughout the country, articles, educational materials to order, and membership and enrollment information.

Submittals for its technical journal are always welcome. For more information about AMCA, including membership info, look on the web. Or, for old-fashioned types, contact: The American Mosquito Control Association, 2200 E. Prien Lake Road, Lake Charles, LA 70601 (318-474-2723).

Skeeter Trivia



Mosquitoes belong to the insect order *Diptera* (the True Flies). Like all True Flies, mosquitoes have two wings. But they differ from flies in that their wings have scales and their mouthparts (in female mosquitoes only) form a proboscis which can pierce the skin (remember, it is only the females that bite).



There are more than 2500 different mosquito species worldwide. Nationwide, 150 species occur in the U.S.



Early Spaniards called the mosquitoes *musketas* (translated as "little fly"). Native Hispanic Americans called them *zancudos* ("long-legged").



Mosquito larvae must live in water from 7 to 14 days depending on water temperature. Larva shed their skin four times during the growth cycle. After the fourth "molt," it becomes a pupa (the resting, non-feeding stage at which time it turns into an adult).

Source: Mosquito information from American Mosquito Control Association web site, in a mosquito information article by Tom Floore. Floore is a member of the Mulrennan Research Center, Panama City, Florida

Mosquito Connection Submittal Guidelines

Your original stories and outside articles are needed to make *The Mosquito Connection* a useful tool for water managers. Submission guidelines are below.

Original articles

In the interest of space, please limit article length to four typed double-spaced

pages, with maximum two photos or graphics. Please submit one hard copy and one copy on 3.5 inch disk, in Microsoft Word 97, or ASCII or "Text Only" format. Label photos, disk, etc. so it can be returned.

Articles of interest (from journals, etc.)

We welcome articles of interest, lists of suggested reading, etc. To the extent possible, we will reproduce these and distribute as newsletter attachments. Of course, entire booklets, or items with multiple color illustrations, cannot be considered. Contact Linda Smith (520-791-5080, Ext. 1465; e-mail LDSmith1@Mail.Ci.Tucson.AZ.US).

Articles Wanted

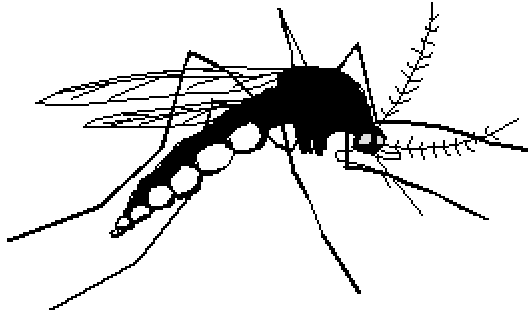
Time flies! It's been one year since we printed our first issue. We thank those who submitted articles or who have let us know how much you enjoyed the issues.

Our original goal was to make this publication a venue for information sharing. This has happened to some extent, but phone conversations and e-mail messages indicate there's a lot of good, unrecognized work happening out there as mosquito control challenges are tackled.

We want to hear from you. Contributing is easy; refer to our submittal guidelines, which appear in every issue. Previously-printed articles also are welcome. Help us continue to share successes and failures so we all learn from the process. For more information or assistance, contact Linda Smith, City of Tucson (520-791-5080, Ext. 1465, or e-mail at LDSmith1@Mail.Ci.Tucson.AZ.US) if you would like to submit an outside article.

Source: City of Tucson, Water Department
Last Revision: December 08, 1999

The Mosquito Connection is produced quarterly by the City of Tucson, Water Department. Its purpose is to provide a forum for sharing information about mosquito control issues at water management projects throughout the state. The content of this publication does not



Please send your comments to:

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